



**An  Publication**  
Office of , Research, and Technical Support  
Bureau for  Africa

# **Dryland Management and the USAID Response in Africa**

*Combating Desertification through Development*

***Technical Paper No. 6***  
***May 1993***





**An *Information* Publication**  
Office of Analysis, Research, and Technical Support  
Bureau for Africa



# **Dryland Management and the USAID Response in Africa**

*Combating Desertification through Development*

**May 1993**

A Review by  
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**Division of Food, Agriculture, and Resources Analysis  
Office of Analysis, Research, and Technical Support  
Bureau for Africa**





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# Foreword

This report has been prepared to provide an overview of what the Africa Bureau of the U.S. Agency for International Development (USAID) has done in recent years in the area of antidesertification. Since antidesertification is not a distinct program category within USAID, it is not possible to comprehensively present all activities in this area. Instead, this report gives illustrative examples of the types of assistance that USAID is providing in dryland management.

USAID has had a special concern with land resources management since 1987, when Congress passed the Development Fund for Africa (DFA) legislation. Through that legislation, Congress directed USAID to focus on priority areas, including maintaining and restoring the renewable natural resources base in ways that increase agricultural productivity. USAID responded by establishing a DFA Action Plan and a regional environmental strategy emphasizing sustainable development and focusing on improving natural resources management in Africa. One of the three agroecological focuses of this strategy was the semiarid zones of sub-Saharan Africa. The Analysis, Research, and Technical Support Office of the Africa Bureau (AFR/ARTS) has just produced a report that chronicles progress by the Africa Bureau in natural resources management during the last five years, *Towards a Sustainable Future for*

*Africa: Improved Natural Resources Management under the Development Fund for Africa, 1987 to 1993*. This complementary document provides further detail of USAID antidesertification programs in the area of natural resources management.

This particular technical report has been prepared by John Gaudet, leader of the environmental unit in the AFR/ARTS Office, with help from Stryk Thomas. The authors greatly appreciate the assistance and general ideas of the members of the International Convention on Desertification (INCD) Technical Working Group, especially Kit Muller (U.S. Department of the Interior), Janice Sessing (National Oceanic and Atmospheric Administration), Tim Schowalter (National Science Foundation), and Paul Blakeburn (U.S. Department of State) for their suggestions. Others who gave us important input for various sections include Walter Knausenberger and Mike McGahuey (AFR/ARTS), Bruce Byers (USAID/R&D), Jonathan Olsson (USAID/Famine Early Warning System Project), and Jim Tucker (National Air and Space Administration).

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# Executive Summary

*Dryland Management and the USAID Response in Africa: Combating Desertification through Development* finds no single element of strategy, or single management technique, that alone will halt or reverse the process of desertification. The review concludes that sound dryland management is an ongoing process, responding to the many variables coming into play and the dynamics between them. The complexity of the issue of desertification demands an exploration of past experience before sound strategies are put forward.

It is obvious, however, that any strategy for combating desertification should include an approach for monitoring, capturing, processing, analyzing, archiving, and disseminating data and information believed relevant to the process. Support for research that helps to identify what the relevant data are should also be included in that strategy.

In the area of desertification over the last few years, the U.S. Agency for International Development (USAID) has carried out numerous projects in development assistance that contain elements devoted to combating desertification—i.e., managing dryland natural resources. Many of the projects now in place were designed following the lessons learned from the 1983–84 drought in Africa and are based on information gained from studies and evaluations completed in the 1980s.

In addition, an extraordinary number of studies, reviews, assessments and evaluations in dryland resource management have been carried out, and USAID has also specifically analyzed 70 promising natural resource management initiatives in four countries: Niger, Mali, Senegal, and The Gambia. This study resulted in the landmark publication, *Opportunities for Sustained Development* (Shaikh et al., 1988). Many of these sites have occasionally been revisited, and several have formed the basis for larger interventions.

USAID's experience indicates that, in the area of desertification, sufficient range of technically proven and economically attractive natural resource interventions are available to halt the decline of rural production systems in arid and semi-arid lands in Africa. Better technological packages can and should be developed, but it is important to recognize that technology is not now the limiting factor. A much larger development challenge is to bring about widespread adoption of the appropriate technologies. The U.S. Government has valuable domestic experience in extension work. Much of this experience should be applicable in Africa once the socioeconomic factors of local communities are taken into account, and the recipients' participation all the way from project design to evaluation is included.

Donors and the public sector will have an important role to play in training and outreach to make viable approaches available to smallholders, provide technical assistance during initial phases, and ensure cost-sharing where direct benefits are insufficient to bring about participation but where high environmental benefits warrant priority allocation of limited public budgets.

In regard to desertification, the coordination of national efforts towards dryland management has been recognized by UNEP and Agenda 21 (UNCED). This coordination clearly is seen as a way of focusing the limited resources available to help in resolving problems in the desertification sector. This coordination could be achieved by incorporation of national Plans of Action to Combat Desertification (PACDs) into National Environmental Action Plans (NEAPs). The NEAP process, in turn, could especially be useful in providing a framework within which nongovernmental organization (NGO) / private voluntary organization (PVO) and regional / village-level participation



would be allowed. The NEAP process could also encourage the kind of local ownership that is needed and called for in Agenda 21. Decision makers and land users need to bond and work together, but this can only be done if there is coordination and cooperation from the beginning of the planning process through implementation. Scientists and donors also need to be involved from the beginning.

Over the last five years, USAID has joined with the World Bank and other donors in the design and implementation of NEAPs. These plans are important in the initiation of a process whereby a country takes control of its environmental/natural resource problems and coordinates the use of all available resources, from a wide variety of donors, in-country agencies, and NGOs/PVOs.

One lesson learned from the planning experience is that, at country level, realistic benchmarks

should be assigned in the desertification effort. Also important are achievable indicators of progress and provision of a “feedback loop” that ensures that country governments and donors react to the benchmarks and indicators.

Experience has demonstrated that it will take 20 years or more before impacts from successful programs become visible on a large scale. Thus, a long-term commitment is needed, as well as the willingness to learn from mistakes. New approaches and the flexibility to adapt goals to new opportunities, as these arise, are important contributors to success.

The obstacle is more often the time needed to bring about participation, rather than the time needed to realize benefits once a technology has been implemented. It is the human, and not the technological, dimension that takes time.

# Glossary of Acronyms and Abbreviations

AFR/ARTS	Bureau for Africa / Office of Analysis, Research, and Technical Support (USAID)
AGRHYMET	Agriculture, Hydrology, and Meteorology (Regional Center in the Sahel)
AVHRR	Advanced Very High Resolution Radiometer
DHV	Development of the Haute Vallée Project (Mali)
FEWS	Famine Early Warning System
FLUP	Forest and Land Use Planning Project (Niger)
INCD	International Convention on Desertification
INRAN	Institut National de Recherches Agronomiques du Niger
NASA	National Aeronautics and Space Administration
NDVI	normalized difference vegetation index
NEAP	National Environmental Action Plan
NGO	nongovernmental organization
NOAA	National Oceanic and Atmospheric Administration
NPA	nonproject assistance
ODA	Overseas Development Administration (United Kingdom)
OHV	Opération Haute Vallée Program (Mali)
PACD	Plan of Action to Combat Desertification
PNRM	Plan for Supporting Natural Resources Management
PVO	private voluntary organization
R&D	Bureau for Research and Development (USAID)
TA	technical assistance
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Program
USAID	U.S. Agency for International Development

# 1. Introduction

## Background

### *Projects*

What has the U.S. Agency for International Development (USAID) done in the area of antidesertification over the last few years? To start with, the numerous projects listed in Table 1 illustrate the kinds of development assistance that USAID has been involved with in dryland areas of Africa. Obviously, all of these projects may have broad development applications, but a surprising number of elements in each are devoted to combatting desertification—that is, managing dryland natural resources such as soils, forests, and range and water resources.

Many of the interventions contained in this general project portfolio were designed following the lessons learned from the 1983–84 drought in Africa and are based on information gained from studies and evaluations completed in the 1980s. Although not all of the projects listed may be completely tailored to local needs (and there is more effort needed here), there does exist a framework of information and data on which USAID depends for its design experience.

### *Studies and Evaluations*

In dryland areas of the world, USAID has carried out many studies in which dryland management is featured: more than 109 since 1980. Table 2 lists studies, reviews, assessments, and evaluations typical of one year (1990–91). In addition, individual USAID Missions in Africa produce and fund studies that are more focused on local conditions and immediate problem solutions. A good example is USAID/Niger, which in 1992 alone carried out 77

studies and evaluations, a selection of which are shown in Table 3. Again, the purpose here is to show that USAID's bilateral effort in dryland Africa *does not lack for information* in quantity. It must be added, however, that there is always room for quality control, and this effort still has a long way to go in the area of localized data bases and in the analysis of information captured at the grass-roots level.

### *National Frameworks*

Over the last five years, USAID has joined with the World Bank and other donors in the design and implementation of National Environmental Action Plans (NEAPs). It should be noted that NEAPs in their initial formulation are meant to be long-term processes, not single “one-off” reports. They are designed to provide a political and strategic overview to permit the more rational allocation of donor, nongovernmental organization (NGO)/private voluntary organization (PVO), and host-country resources. Local control and participation are meant to be central attributes of NEAPs (these remain some of their most attractive features) and perhaps could make up for the deficiencies in bilateral project design, as noted above. Thus, if the participatory approach is lacking in any project in a given portfolio, a strengthened NEAP could compensate by encouraging a change in the course of project design and implementation.

Of course, the success of any NEAP in Africa depends directly on the thoroughness with which all the factors of resource utilization are considered. Especially pertinent are those informal sector activities that end up playing such a vital role in determining how, when, and by whom “common” natural resources are actually utilized. This focus

necessitates that NEAPs be long term in both design and orientation. NEAPs are therefore important in the initiation of a process whereby the country takes control of its environmental/natural resource problems and coordinates the use of all available resources, from a wide variety of donors, in-country agencies, and NGOs/PVOs. The USAID

Africa Bureau thus looks to them as a key tool in program design.

### *Interventions*

Given all of the above, how then do the interventions stack up within an individual USAID project

**Table 1**  
**USAID Activity in Natural Resources, Environment, and**  
**Sustainable Agriculture in Sub-Saharan African Countries**  
**Affected by Desertification**  
(U.S.\$ 000s)

Burkina Faso	Pilot Village Natural Resource Management	2,000
Cape Verde	Watershed and Applied Research	9,000
Chad	PVO Development Initiatives	13,275
Kenya	Conservation of Biodiverse Resources	7,000
	PVO Cofinancing	8,702
	Park Rehabilitation and Management	1,250
Mali	Integrated Pest Management	2,000
	Development of Haute Vallée	17,500
	Village Reforestation	2,921
	PVO Cofinancing	3,220
Niger	Mali Environmental Support	2,300
	Disaster Preparedness and Mitigation (NPA)	12,000
	Disaster Preparedness and Mitigation (TA)	8,000
	Agriculture Sector Development Grant II (NPA)	15,000
	Agriculture Sector Development Grant II (TA)	8,000
Senegal	Goure Natural Resources Management Interventions	3,000
	CARE Maradi Microenterprises	6,000
	Strengthening Agricultural Research	19,750
	Southern Zone Water Management	17,000
Sahel Region	Senegal Reforestation	12,000
	Community-Based Natural Resources Management	25,000
Africa Region	Sahel Regional Institutions	15,000
Southern Africa Region	Policy, Analysis, Research, and Technical Support	46,100
	Southern Africa Natural Resource Management	46,530
TOTAL US\$		302,548

Source: USAID 1993 CP-Statistical Annex.

effort? Chapter 2 goes into more detail about this. Suffice it to say here that there have been some successes in addressing localized cases of desertification, and it is those cases that will provide models for the future.

As to the problem itself, before discussing interventions and particular cases, it would be best to define the phenomenon of desertification and to digress briefly on its complexity.

## Statement of Understanding

### Definition

This paper uses the definition of desertification based on that of the United Nations Conference on the Environment and Development (UNCED), as it was developed in Agenda 21. Desertification is “*Land degradation in arid, semiarid, and dry subhumid areas resulting from various factors, including climatic variations and human activities.*”

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**Table 2**  
**USAID-Supported Studies and Evaluations in Dryland Management and Desertification: 1990–91**

- Day, John. 1991. *Completion Report: Economic Component Technology for Soil Moisture. (Dryland Soil Management)*. Washington, D.C.: U.S. Agency for International Development.
- Erikson, John, et al. 1991. *Morocco Dryland Agriculture Applied Research: Mid-Term Evaluation*. Washington, D.C.: Chemonics International.
- Gray, Clarence, et al. 1991. *Report of the External Evaluation of the Technology for Soil Moisture Management Project*. Washington, D.C.: U.S. Agency for International Development.
- Joshi, Pramod, et al. 1991. *Farm Level Effects of Soil Degradation in Sharda Sahayak Irrigation Project*. New Delhi: Indian Council of Agricultural Research.
- Pagiola, Stefano. 1991. *Cost-Benefit Analysis of Soil Conservation (Soil Erosion)*. Bethesda, Md.: Abt Associates.
- Vonshak, Avigad, et al. 1991. *Final Report, May 1986–May 1991: Strain Selection of Spirulina Algae Suitable for Mass Production—A Novel Agrotechnology for Arid Lands*. Sede Boqur: Ben Gurion University of the Negev.
- Gambia, Ministry of Agriculture and Natural Resources. 1990. *National Natural Resource Policy: Republic of the Gambia, West Africa—Final Policy Document*. Banjul, Gambia.
- National Research Council. 1990. *Improvement of Tropical and Subtropical Rangelands*. Washington, D.C.: National Academy Press.
- Organization of American States. 1990. *Disaster Planning and Development: Managing Natural Hazards to Reduce Loss*. Washington, D.C.: Organization of American States.
- Reich, Allen, et al. 1990. *Microsites of High Potential in the Pastoral Zone of Niger: Reconnaissance, Determination, Classification, and Evaluation*. Ann Arbor, Mich.: University of Michigan.
- World Resources Institute. 1990. *Toward an Environmental and Natural Resources Management Strategy for ANE Countries in the 1990s*. Washington, D.C.: World Resources Institute.

Source: USAID CDIE 1993.

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## *Causes of Desertification*

Desertification typically occurs at the fringes of deserts (which themselves have been created over long periods of time by natural phenomena), though their presence is not a prerequisite for desertification. These fringes or transition zones represent delicately balanced ecosystems where a variety of microclimates can be found. Degradation of the land can occur as humans stress these transition zones with their activities. This human-induced degradation interacts with natural phenomena in complex ways that can alter the ecosystem and intensify the degradation. Whether it can be stopped

or reversed is a question of much debate. To understand the process of desertification, one must develop an awareness of the interactions between variables such as climate, population growth, and human land use under conditions of change. The problems with, and controversy surrounding, the term *desertification* stem from a real lack of ecological knowledge about arid and semiarid lands, and their resilience under different kinds of land use pressures.

Research by the US National Science Foundation on desertification processes at arid and semiarid sites has indicated that desertification results from the following series of steps:

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**Table 3**  
**Selected USAID/Niger Dryland Management Studies in 1992**

- Boa, Eric. *Neem Disorder and Neem Scale in Nigeria*. Chatham: Natural Resources Institute for Overseas Development Administration.
- Catterson, Thomas, et al. *Natural Resource Management and Program Food Aid in Niger: An Initial Analysis of Linkages*. Bethesda, Md.: Abt Associates.
- Elbow, Kent. *Popular Participation in the Management of Forest Resources: Lessons from Baban Rafi Forest, Niger*. Ph.D. dissertation, University of Wisconsin, Madison.
- Hodges, Charles, et al. *Evaluation of a Disorder of Neem in Niger*. Washington, D.C.: U.S. Department of Agriculture.
- Hopkins, Chris. *Remeasurement of the 1982–83 Test Cut at the Guesselbodi Forest*. Niamey, Niger: Projet Energie II.
- Hopkins, Jane, et al. *Food Consumption Patterns and Crop, Livestock, and Non-Agricultural Product Transactions of Rural Households in Western Niger*. Washington, D.C.: International Food Policy Research Institute, and Niamey: Institut National de Recherches Agronomiques du Niger (INRAN).
- Issa, Aboubacar. *Analyse des Taux de Survie des Plantations CARE*. Niamey: CARE International.
- Manu, A., et al. "Fertility Status of Selected Millet Producing Soils of West Africa with Emphasis on Phosphorus," *Soil Science*, 152 (5).
- Naugle, Jonathan. "Forage Manuel de Puits en PVC pour le Maraichage au Niger." Fiche Technique in *Baobab 7*.
- Norman, W. *A Field Manual for Water Lifting and Management in Small-Scale Irrigation Systems in Niger*. Niamey: INRAN.
- Rachmeler, Dale. *Seed Multiplication in Niger 1975–1992*. Ann Arbor, Mich.: University of Michigan.
- Rands, Barry. *Experiences in Soil and Water Conservation Work amongst Pastoral Peoples of Northeastern Mali*. Iowa: Soil and Water Conservation Society.
- Satana, Suha. *Guides d'Utilisateur des Données Agricoles au Niger*. Niamey: Ministère d'Agriculture.
-

1. initial vegetation reduction as a result of over-grazing or harvest;
2. redistribution of sediments, nutrients, and soil moisture from nonvegetated zones to vegetated zones;
3. soil desiccation and nutrient impoverishment in nonvegetated zones, which stress vegetation in fringe areas, leading to vegetative recession;
4. soil desiccation, which also contributes to the development of a calcified layer that inhibits deep water penetration and storage; and
5. positive feedback between vegetation reduction and soil desiccation and nutrient impoverishment, which accelerates vegetation stress

and decline.

Desertification of arid and semiarid lands could then be said to result from a combination of natural fluctuations in drought, coupled with delayed reductions in land uses by humans during unpredictable periods of drought.

### *The Cyclic Nature of Desertification*

Regional climates tend to fluctuate in weak 3- to 4-year cycles (some suggest 10- to 20-year cycles) with a high amplitude of wet or dry conditions. Human activity can contribute to either the accen-

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Sivakumar, M.V.K., et al. *Relation Between Climate and Soil Productivity in the Tropics*. Madison, Wis.: Soil Science Society of America and American Society of Agronomy.

Taylor, George, et al. *Trees and Forests in the Management of Rural Areas in the West African Sahel: Farmer Managed Natural Regeneration*. Nairobi: United Nations Environment Program.

Taylor-Powell, Ellen, et al. *Integrating Gender in Small Ruminant Research and Extension: A Case from Niger*. Niamey: USAID/Niger, submitted for publication.

U.S. Agency for International Development (USAID). *Plan for Supporting Natural Resource Management in Sub-Saharan Africa—Regional Environmental Strategy for the Africa Bureau*. Washington, D.C.: USAID.

USAID/Niger. *1992 ANP Briefing Book: An Overview of the Program and Activities of the USAID/Niger Office of Agriculture, Natural Resources, and Private Sector Development*. Niamey.

\_\_\_\_\_. *Proceedings of the Round Table on Rural Finance held at USAID/Niamey December 17, 1991*. Niamey.

Vandenbelt, R. J., ed. *Faidherbia albida in the African Semi-Arid Tropics: Proceedings of a Workshop 22–26 April 1991, Niamey, Niger*. Nairobi: International Crops Research Institute for the Semi-Arid Tropics and International Centre for Research in Agroforestry.

Verma, P. K., et al. "Effect of Shading on Cowpea Growth in Sub-Saharan Africa." *Agronomy Journal*, under review.

\_\_\_\_\_. "Effect of Crop Residue on Millet Production in Niger." *Agronomy Journal* 20 (3–4).

\_\_\_\_\_. "Effet de Petit Mil et Niébé en Culture Continuée sur la Productivité et Fertilité du Sol." *La Revue de la Recherche Agronomique*. Niamey: INRAN.

Wyllie, Bruce, et al. "Estimating Herbiage Standing Crop from Rainfall Data in Niger." *Journal of Range Management*, 45 (3).

Wilson, Wendy. *Women in Niger: Socio-Economic Roles in Agro-Pastoral Production, Natural Resource Management, and Off-Farm Production*. Washington, D.C.: USAID.

Source: Taylor, George, pers. comm. 1993.

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tuation or the dampening of these amplitudes by their intensity of plant and/or soil disturbances during periods of drought. Vegetation removal exposes soil surfaces to direct solar radiation and increases soil reflection (albedo). In addition, global circulation models demonstrate that increased albedo results in a feedback mechanism to the local climate that increases the probability of continued drought. This means that land use practices, to be effective, must be modified early in the drought cycle to alleviate this feedback and to retain the structural and functional properties of soils such as water infiltration or nutrient cycling (Muller 1993). In numerous cases in Africa, farmers have used investments in simple management practices to restore land productivity. These are primarily financial decisions and thus point out the critical link between land degradation and local vested interest (McGahuey 1993).

### *The Effect of Vegetation*

Given the fact that indigenous plants and animals have evolved mechanisms to tolerate variations in local climates, it is not surprising that dryland plants have adaptations to cope with variable precipitation. But these same plants are often less capable of surviving extended droughts when continuously cropped (e.g., grazed or gathered). In addition, ephemeral plants rely on the seed phase of the life cycle to survive drought periods. Grazing of ephemerals during early growth can often be tolerated, but grazing during flower and seed production will result in a decline of these species within the ecosystem. Herbaceous perennials are most at risk, since they produce foliage when moisture is available. This same foliage senescens, and whole plants become dormant during drought periods. Renewal buds for these plants are located at or below the soil surface, thus they tend to be most vulnerable to use later in the growing season when these buds are elevated (Muller 1993).

### *Land Use*

Use of arid lands can be sustainable, provided that timing, duration, and intensity of use are sufficiently flexible during early signs of drought. When precipitation is adequate for plant growth, then land uses must be compatible with the maintenance of physical and biological components of the ecosystem.

Adverse human impacts in areas vulnerable to desertification are often due to poor practices of soil conservation, agricultural cultivation practices, livestock grazing, and urban settlement patterns. Sustained high levels of stress on these already fragile environments by human populations eking out their existence on these ecosystems during short-term periods of drought can be long-lasting or irreparable, sometimes even resulting in increased desertification.

### **There Is No "Silver Bullet"**

In conclusion, there is no single element of strategy, or single management technique, that alone will halt or reverse the process of desertification. Sound dryland management is an ongoing process, responding to the many variables coming into play and the dynamics between them. The complexity of the issue of desertification demands an exploration of past experience before a sound strategy can be put forward.

In fact, technically based prescriptions should be avoided. Farmers sometimes choose the land management option that is different from the "prescription" of the technical expert. Their decisions are driven by such concerns as secure tenure, access to credits and markets, lack of first-hand experience with the "prescribed" technology, and social pressures.



## 2. Experience to Date

### Has Anything Worked?

The simple answer is yes. USAID specifically analyzed 70 promising natural resource management initiatives in four countries: Niger, Mali, Senegal, and The Gambia. This study resulted in the landmark publication, *Opportunities for Sustained Development* (Shaikh et al. 1988). Many of these sites have occasionally been revisited, and several have formed the basis for larger interventions.

This section examines what has worked and some lessons that have been learned before, during, and since the 1983–84 drought experience in Africa. Interventions in natural resources management at the ground level, revised and amended farming techniques, and disaster mitigation illustrate the scope of USAID's work in dryland management in Africa.

### Case Studies of USAID-Funded Dryland Management

#### *Opération Haute Vallée*

USAID's Development of the Haute Vallée (DHV) Project has assisted the Government of Mali's implementation of the Opération Haute Vallée (OHV) program. After more than 10 years of activity, the OHV program has contributed to significant increases in agricultural productivity and sustainable development in an area that now incorporates 106 villages. The collection and use of animal manure has increased the efficiency of chemical fertilizer, thus enhancing the fertility of the soil while lessening the potential for environmental danger (USAID/NRMS 1991).

Although exact figures are not yet available on how much the fertility of the soil has been enhanced, productivity figures certainly suggest that the increase has been substantial. Yields per hectare have increased, and the range of crops under cultivation has expanded to include rice, *gorum-gorum*, and *dolique*, all of which were not previously grown in the area. One farmer, François Coulibaly in the Koulikoro region, produced 400 kg/ha of millet, 600 kg/ha of sorghum, and 800 kg/ha of peanuts prior to his participation. Through his involvement in OHV, Coulibaly has effectively doubled his productivity without clearing substantial areas of new farmland (USAID/NRMS 1991).

The success of OHV is in large part attributable to the facility with which knowledge and access to implementation has spread through the Niger valley. What started off as a pilot program in a single village has now reached out to over 100 villages via a network of extension-agent-training programs, farmer-to-farmer visits, agricultural field days, and media broadcasts. The tangible success of farmers like François Coulibaly is the single most convincing argument in getting other area producers to adopt similar practices. No longer are the benefits merely theoretical promises made by detached extension agents whose sincerity and commitment to local producers are far from assured.

OHV has engaged in decentralizing rural development through the creation of local credit funds. The project was designed to thus function independently once begun, without government subsidies or donor funds. Work in conserving soil fertility reduced the need for frequently expensive and often unnecessary chemical fertilizers. This was a welcome relief to village credit funds. More money was now available for the funds' other activities, such as contour dikes, windbreaks, and

agroforestry projects. In 1990 alone, over 10,000 *Faidherbia albida* trees were planted, a species that improves soil fertility and produces a valuable forage crop for livestock (USAID/NRMS 1993).

#### *The CARE Majjia Valley Windbreak Project*

USAID has supported a windbreak project in the Majjia Valley in Niger, managed by the PVO CARE. This Sahelian valley has deep alluvial soils and a shallow water table, but wind erosion is severe and has carried away much valuable topsoil. Crops are often sown several times because seeds or seedlings become buried or blown away. Fallow periods have become rare, with most fields coming under permanent cultivation. In this case, the specific constraints addressed by windbreaks have included loss of topsoil and soil moisture, mechanical damage to crop seedlings, and declining crop yields. Windbreaks were first planted in 1975, mostly consisting of neem trees with the later addition of some *Acacia nilotica* along windward lines. By the end of 1988, 463 km of windbreaks had been established protecting an area of 4600 ha (Erdmann 1992).

Windspeed was reduced by an average of 42 percent (and up to 80 percent), leading to decreased wind erosion and evaporation and increased soil moisture (Erdmann 1992). Possible increases in millet yields have been observed, though studies have been inconclusive due to high variability of yields in different plots. Economic benefits to local people have included the sale of harvested windbreak wood (pollarding 1 km of 10-year-old trees yields 900 poles and 12 cubic meters of firewood worth \$1,307 [Erdmann 1992]), project employment as nursery workers and guards, and increased vegetative growth of the millet stalks, which translates to increased fodder for livestock.

In hindsight, the biggest problem with the Majjia Valley project was that not enough was done to involve the local community in the establishment and maintenance of the windbreaks. A sociological study conducted in 1984–85 showed that while 90 percent of the respondents thought they benefited from the

windbreaks, only 2 percent thought they owned the trees (Erdmann 1992). Sustainability has also been an issue, and doubts have been raised as to whether windbreak establishment and management can survive after external funding ceases. Receipts from the sale of windbreak products may not be enough in the long run.

#### *Forest and Land Use Planning Project*

Guesselbodi National Forest in Niger has been the site of a promising natural forest management initiative. USAID funded the Forest and Land Use Planning project (FLUP), which chose Guesselbodi as one of its model sites in 1981. The forest was severely degraded at the start of the project: 40 to 60 percent of the total vegetative cover had disappeared between 1950 and 1980 (Erdmann 1992). The initiative was based on local participation in forest management from the start and on the use of forest resources to generate income to pay for this management. Wood was harvested from live woody perennials (coppice regeneration supplying wood for the next cycle), and livestock was excluded from a newly cut parcel for three years. Parcels were also improved by constructing physical contour barriers on slopes. Villagers harvested grass from the protected parcels and sold it as hay. A woodcutters cooperative was later formed, and proceeds generated by wood-cutting and grazing permits were deposited into a forestry fund and paid for recurrent management costs. The Government of Niger agreed to reduce permit fees for wood coming off managed land. Cut wood was sold to the cooperative, which then sold the wood to traders. The profits were divided between the forestry fund (75 percent) and the cooperative (25 percent) (Erdmann 1992).

Some of the techniques used in the project—mulching, physical contour barriers, and microcatchments—achieved positive results. Fifty percent survival of seedlings was reported in 1984 with only 233 mm of rainfall (Erdmann 1992). Managed tree cutting proved effective (3-meter coppice shoots were recorded from *Combretum nigricans* stumps cut a year earlier), and rapid

regeneration of grass occurred in protected parcels. The latter convinced villagers that controlled management of the forest was beneficial, and by 1985 the number of livestock caught in protected parcels had significantly decreased. Cooperative and forestry fund proceeds grew: in 1987 (the year cutting began) they were roughly \$430 and \$1,600, respectively; in 1989, they had grown to \$3,180 and \$4,700 (Erdmann 1992).

Despite its achievements, Guesselbodi faces potential problems. The harvesting of wood on a relatively short rotation, and the annual harvesting of grass, could have negative long-term effects. Also, sustainability is again uncertain: some doubt exists as to whether revenues generated from fuelwood sales can sustain the cost of fully rehabilitating a given parcel. Financial management of the cooperative still requires outside assistance, revenues from the forestry fund have yet to be disbursed, a grazing plan amenable to all concerned has not been devised, and women have largely been excluded from project activities (Erdmann 1992). But, at this time, one fact stands out: the Guesselbodi National Forest is more densely forested than it was 10 years ago, the composition mix is richer, and revenues from the management are substantially greater.

Before the FLUP project in the Guesselbodi forest in Niger began, forest resource policy decisions were tightly controlled by the Nigerien Government through its centralized Forest Service. Commercial exploitation of a national forest such as Guesselbodi was prohibited, and cultivation was permitted only by contract, while livestock enjoyed unrestrictive use of the land. This was at odds with local people, who, due to a lack of resources and incentives, could not curtail their overexploitation of the forest resources. The results of the FLUP project induced the Forest Service to alter its policy at Guesselbodi. This realization later led the Nigerien Government to alter its Rural Code (McGahuey 1993).

### *Rural and Forestry Code Reforms*

USAID has promoted the reform of rural and forestry codes in Niger and Senegal so that they reflect sounder natural resources management principles and encourage conservation through sustainable use at the local level (McGahuey 1993). The Land Tenure Center at the University of Wisconsin, funded by USAID, has advised the Nigerien Government in its overhaul of the rural code, passed into law in December 1992. Major issues in the reforms included decentralizing policy making and management, allowing private initiative, and permitting some sustainable use instead of human-exclusive conservation. The FLUP project in Guesselbodi had broken the ice in many ways, as it marked one of the first instances where the Nigerien Government allowed deviation from its strict land use policies. The successes at Guesselbodi then encouraged the reforms in these policy areas of the rural code.

### *The Senegal Reforestation Project*

In 1988, USAID initiated the Senegal Reforestation Project through the Land Tenure Center. The project contained a matching grant component designed to mobilize rural communities, farmers, and economic operators to invest in reforestation. This component established agreements to provide reimbursement funds to individuals or groups who had undertaken a forestry activity with some degree of success. Individuals and groups were reimbursed as a means of defraying costs incurred during the reforestation activity. The amount depended on the level of success of their efforts: the number of living trees after the first year of the activity. The program was implemented through forestry extension agents, who worked directly with local groups and individuals, with support of the project.

The project is still in progress, so a final evaluation has yet to be done. In 1991, a monitoring survey was completed (Timberlake 1992), and results show that the matching grant program appears to be having a positive impact on changing

forestry-related perceptions, knowledge, and practices. Village respondents to the survey indicated that they participated in the program for the later economic benefits of the sale of forest products (60 percent of those surveyed) rather than home consumption (40 percent). Men participants found the greatest use of the money as a financing source (43 percent), while 50 percent of the women stated that they spent the money for family living expenses (Timberlake 1992).

Certain constraints demand modifications in the project's design. Water often poses a major limitation to reforestation efforts. Thus, related activities in addition to matching grants are being

considered. For instance, funding for wells might be partially provided if it could be demonstrated that a significant reforestation activity, such as a nursery or plantation, would be undertaken. The forestry agents have a very influential role in advising the project's participants, yet they are hampered by problematic transportation to project sites. They play a large part in decision making regarding the reforestation and matching grant activities. As the key to the program's success, the agents need further training and more mobility to better help participants achieve their forestry goals (McGahuey 1993).

# 3. The USAID Strategy for Natural Resources Management in Africa

## Agenda 21

The first priority in combating desertification according to Agenda 21 of the United Nations Conference on Environment and Development (UNCED) should be “the implementation of preventive measures for lands that are not yet degraded, or which are only slightly degraded. This is recognized in the United Nations Plan of Action to Combat Desertification. In combating desertification and drought, the participation of local communities, rural organizations, national governments, NGOs and international and regional organizations is essential” (UNEP 1992).

Any strategy for combating desertification should include an approach for monitoring, capturing, processing, analyzing, archiving, and disseminating data and information believed relevant to the process. Support for research that helps to identify the relevant data should also be included in that strategy. Most important, the strategy should be grounded on the fact that ultimate success or failure depends on the natural resources management decisions made by hundreds of thousands of farmers, herders, woodcutters, and fishermen as they pursue more secure and prosperous livelihoods. For this reason, antidesertification programs need to be based on an ever-improving understanding of how these individuals make management decisions. Prescriptive approaches based solely on technical considerations should be avoided. And appropriate technical knowledge may reside more with those who have experience managing the land and less with experts from the outside.

## *A USAID Plan for Supporting Natural Resources Management*

The USAID Africa Bureau’s Plan for Supporting Natural Resources Management (PNRM) was initially approved in 1987 and updated in 1992 (PNRM 1992). The PNRM presents a strategy for formulating and executing Mission-level programs, particularly those that seek to address the problems of desertification, deforestation, soil degradation, and the loss of biological diversity. It establishes priorities by subject matter and country.

Although some modification has occurred since 1987, the PNRM has provided a basic consistency to USAID’s strategy for sub-Saharan Africa over the past five years. It responds to the role of resources management programs in promoting sustainable agriculture and contributing to broad-based economic growth.

In preparing the PNRM, regional experts conducted in-depth assessments of past programs in consultation with knowledgeable and experienced members of PVOs, NGOs, and the academic community. The PNRM has become an integral part of activity assessment in most USAID Missions in sub-Saharan Africa, utilized in the upgrading of ongoing projects and the designing of new activities.

More recently, USAID has studied its experience over the last five years in improving natural resources management under the Development Fund for Africa. Its report focuses on what has been accomplished to stimulate economic growth that makes optimum use of Africa’s resources in a manner that will ensure prosperity for future generations of Africans (USAID 1993b).

## Desertification as Addressed Under the USAID Strategy

In the area of desertification, a sufficient range of technically proven and economically attractive natural resource interventions are available to halt the decline of rural production systems in arid and semiarid lands in Africa. Better technological packages can and should be developed, but technology is not now the limiting factor. A much larger development challenge is to bring about widespread adoption of the appropriate technologies. The U.S. Government has valuable domestic experience in extension work. Much of this experience should be applicable in Africa once the socioeconomic factors of local communities are taken into account and the recipients' participation is included all the way from project design to evaluation.

Donors and the public sector have an important role to play in training and outreach to: make viable approaches available to smallholders, provide technical assistance during initial phases, and ensure cost-sharing where direct benefits are insufficient to bring about participation but where high environmental benefits warrant priority allocation of limited public budgets.

USAID's experience indicates that two broad strategies are essential. That is:

1. *Spread existing technologies.* The highest priority at all funding levels should be the *deployment* of existing technologies that have positive and financially attractive impacts at the farm and/or village levels and that help to meet criteria necessary for a sustainable system. Deployment of existing technologies and strategies have been observed to have substantial and enduring impacts on the capacity of farms and villages to produce food, forage, wood, and other products. Farmer acceptance appears to be as dependent on risk reduction as on the potential for yield increases. Opportunities to earn cash income that reduces economic risk can be a powerful motivating factor.
2. *Increase the productive potential.* At the medium and higher funding level, research should be supported that reduces risks and increases efficiencies of higher yielding technologies and germplasm. Results of this kind of research should be introduced wherever evidence is seen that improved natural resources management techniques have been successfully adopted. Field evidence strongly suggests that the efficiency of higher yielding technologies and germplasms will be increased when existing methods of soil and water conservation and fertility improvement have already been applied.

### *Recommendations by Intervention Category*

A host of successful interventions have demonstrated that the following techniques often can easily be incorporated into new or ongoing project interventions (Shaikh et al. 1988):

- *Soil fertility improvement:* Focus resources on supporting regeneration of field trees, on manure management, on mineral fertilizer, and on improving rhizobium adaptability.
- *Soil and water conservation:* Extend actions that reduce soil erosion and that increase the soil's capacity to retain available water.
- *Maintaining vegetative cover:* Support establishment and maintenance of a permanent cover of woody perennials.
- *Training and human development:* Increase the capacity of personnel to manage soils and vegetation, encourage linkages across sectors, and support advanced training of personnel capable of establishing priorities and plans for management.
- *Sectoral collaboration:* Use diversified aid portfolios to encourage collaboration.
- *Focusing resources on strategic goals:* Promote host-country and multidonor agreement on strategy objectives over a 20- to 30-year time frame, and also promote creation of a more structured coordination process for monitoring of progress and allocation of scarce

donor and government resources.

- *Resource tenure*: Work to establish clearer and more secure tenure systems.
- *Tax incentives*: Support policies to reflect the long-term economic costs of replacing dwindling wood supplies.
- *Financing natural resources management*: Encourage the creation of “revolving funds” managed at local and village levels to provide credit to small farmers for improved management. Include training in enterprise and credit management.
- *Contingent incentives*: Provide cash or other incentives—contingent on implementation of a package of natural resources management activities.
- *Soil fertility research*: Support agroforestry and manure management research, as well as mineral fertilizer research to complement agroforestry and manure management; link it with water-conserving research.
- *Soil and water conservation research*: Emphasize contour dikes, late season plowing, and windbreaks.
- *Vegetation management research*: Findings on the carrying capacity of natural vegetation will be extremely important in establishing principles for local resources management.

## Essential Elements for Success in Africa

### *Focus and Definition*

“Desertification” as a topic has been a major discouragement to multilateral and bilateral donors—mostly because the term was earlier seen as a general catch-all, including virtually anything related to drylands, drought, famine, environmental refugees, and so forth.

As noted in a recent report by the U.K. Overseas Development Administration (ODA): “In the last five years, the terms of the debate have changed from ‘combatting desertification’ to ‘improving natural resource management in dryland regions.’ This is more than just a change in terminology, and

helps shift attention to the institutions responsible at local and national levels for managing how natural resources are actually used” (Toulmin 1992). The focus must be on the prevention of desertification rather than on providing technical fixes to areas already desertified. The cost of restoration is many-fold greater than the cost of proper land management.

A fresh start is clearly needed. To begin with, the earlier interminable discussions of what is meant by “desertification” should be avoided. It is assumed that the definition used will be that developed and used at UNCED (quoted in Chapter 1 of this paper). The next step would be to ensure that everyone involved (host countries, NGOs/PVOs, international organizations and donors) would be willing to look again at the goals and objectives within country programs and that they would do so in a much more realistic way than in the past.

Plans to combat desertification must be based on sound science that recognizes that natural resources are finite (not inexhaustible), have intricate interrelationships, and are integrally linked with the well-being of the rural producers. Also, plans must be strategic and they should be developed with a vision and a clear definition of the limiting constraints. An honest assessment must be made of financial and physical capabilities and the limits of the natural resources affected. Plans must focus on real problems and issues which are evaluated holistically. Proposed uses must match the ecosystem within which they are located.

It is extremely important that implementation be kept in focus from the beginning of the effort. Cultural viewpoints and values, religion, and other differences must be recognized and dealt with to assure that the proposed actions are realistic and implementable. Also, mitigation and management prescriptions must be placed within the cultural context of the population and groups who have a vested interest in the plan.

To understand those factors which cause landscape change, both physical and biological ecosystem controls must be understood (i.e., temperature and precipitation regimes, migrations and competition). In certain ecosystems, disturbances such as

fires may have been a part of the original system. It is also important not to underestimate the ability of systems to restore themselves, just as it must be realized that natural systems have buffering capabilities for disturbances. But if the natural resources are overused, the buffering capabilities suffer and the system is eventually lost.

### *Empowerment*

Previous approaches towards desertification have involved a set of top-down directives, plans, and interventions. The early effort at establishing a Plan of Action to Combat Desertification (PACD) was often viewed as a plan expeditiously designed by a “chosen few.” By UNEP’s own admission, the early PACD process did not work. Why? An external evaluation of the PACDs designed over the period 1978 to 1989 concluded that their failure was due in part to shortcomings of the PACDs themselves—notably their *lack of focus and their omission of socioeconomic factors* (UNEP 1992b).

In reply, UNEP pointed out that the shortcomings of the PACD process were also due to the fact that almost all agencies involved (donor governments, intergovernmental organizations, aid agencies, and NGOs) “failed to accord high priority to restoring degraded land” and “tended to favor agricultural projects, as a means of reversing desertification.” UNEP felt that, even when the land resource base was fast being depleted by degradation, these same agencies were reluctant to fund programs in pastoral areas where nomadic or seminomadic peoples were rapidly degrading rangeland by overgrazing (UNEP 1992b).

At this point, a more productive approach is needed. To begin with, to help empower regional and village-level groups, a more participatory, more transparent method should be used in the country planning stage. Due to funding processes and elections, government programs usually are necessarily of short duration. If implementation is to be completed, it is extremely important to obtain local commitment and support of the vision and long-term objectives involved.

### *Coordination and Cooperation to Avoid Duplication of Effort* (e.g., *National Environmental Action Plans*)

Basically, the NEAP is an in-country demand-driven process, based on considerable local participation and is intended to provide a framework for integrating environmental considerations into a nation’s economic and social development. It aims to define a time-bound plan that outlines environmental policy needs, institutional and legal reforms, corrective measures to ongoing development programs, and new investment programs needed in the environment sector.

The U.S. Government (through USAID), working with the World Bank and other multilateral and bilateral donors, has provided the initial impetus and stimulation to the development of many of the NEAPs in African countries.

In regard to desertification, the coordination of the national effort towards dryland management has already been recognized by the United Nations Environment Program (UNEP 1992b) and Agenda 21 (UNEP 1992a). In both cases, it is cited as an important step in focusing the limited resources available to help in resolving problems in the desertification sector. This coordination could be achieved by incorporation of the national PACD into the NEAP process. The NEAP, in turn, would especially be useful in providing a framework within which NGO/PVO and regional/village level participation would be encouraged. The NEAP process would also encourage the kind of local ownership that is needed and called for in Agenda 21. Decision makers and land users need to bond and work together, but this can only be done if there is coordination and cooperation from the beginning of the planning process through implementation. Scientists and donors also need to be involved from the beginning.

There should be improved sharing of resources between existing national and international organizations interested in desertification issues. This sharing of resources could include exchange of personnel and data, joint conduct of research and development projects, and other cooperation. For



instance, there are existing facilities/institutions, such as the AGRHYMET Regional Center in the Sahel (partially funded by USAID), which are already an integral part of weather and climate services.

### *Policy Reform and Structural Adjustment*

Experience demonstrates that it will take 20 years or more before impacts from successful programs become visible on a large scale. Thus, a long-term commitment is needed, and the willingness to learn from mistakes. New approaches and the flexibility to adapt goals to new opportunities, as these arise, are important contributors to success.

The obstacle is more often the time needed to bring about participation, rather than the time needed to realize benefits once a technology has been implemented. It is the human, and not the technological, dimension that takes time. Adaptation of technologies, and incentive systems to spread them, has often been a slow process. The *minimum* time horizon is commonly estimated to be 20 years in the Sahel.

Policy reforms need to begin with some fundamental understanding of the *values* that the policy is meant to promote. In the case of desertification, the main values question is "Productivity defined how and for whom?" If "productivity" is defined only from the perspective of current human users, for example, there is still a question of *which* human users are being favored. The commercial (sometimes export-oriented) livestock sector may be favored by one kind of policy, and the subsistence, self-sufficient pastoralist sector favored by another kind of policy (McGahuey 1993). There is also the question of arid land biodiversity. Although species diversity is lower in arid lands than in the rainforests, which have attracted so much attention recently, arid land species are no less unique, have no less potential for human use and benefit, and are no less threatened than rainforest species, in many cases. To protect biodiversity, a different, less consumptive standard of "productivity" may be needed, and this would be reflected in policy.

In market economies, those who use a natural

resource should pay for that use, including use of air and water resources. If in the process of using a resource, there is degradation of a capital asset, the user should pay. Conversely, if there is improvement of a capital asset, the user should receive credit.

Policy reforms need to recognize that degradation of natural resources on arid and semiarid lands is not linear. There are thresholds that when crossed will never allow for a return to the original condition. Thus, it is important to establish baselines and a threshold that degradation must not pass.

As new policies are developed, the full cost of the proposed action needs to be taken into consideration. This includes direct and indirect costs. Intrinsic values of soil, water, and other natural resources also need to be considered, along with a recognition that they are finite and have significant interrelationships.

Incentives need to be created to promote teamwork and good stewardship of the land and natural resources. Incentives that cause misuse of natural resources should be eliminated or at least minimized.

More diverse, less intensive farming practices should be encouraged, as should more nomadic herding of less destructive livestock. However, it is clear that management of lands in common by a group of individual users does not work. Open range for use by livestock in the United States in the early 20th century provides one excellent example. So, some form of land tenure appropriate to the local socioeconomic circumstances must be provided to the users. Incentives must be provided for good stewardship, and those incentives that result in misuse of natural resources should be minimized or eliminated.

### *Application, Extension, and Transfer of Appropriate Technology*

Applicable data must be obtained and used to establish the parameters of the program and to make informed decisions about the existing circumstances and the impacts that will result from implementation. Technology transfer to the users

is essential if the program is to be successful. This will improve their understanding and make them more able participants in the planning process and implementation.

One example is in the area of remote sensing. Increased local access could be provided to the U.S. National Oceanic and Atmospheric Administration's (NOAA's) Advanced Very High Resolution Radiometer (AVHRR) data, as well as data from the appropriate geostationary environmental satellite. This could be accomplished through the development of low-cost ground stations for these data, placed in existing or new governmental or multinational facilities in each country. Such data could be readily shared between potential users within and outside the country. UN agencies or intergovernmental agreements could help provide international compilation and sharing of such data for the benefit of humankind.

The U.S. National Aeronautic and Space Administration (NASA), with USAID funding, has used NOAA's AVHRR data to determine the rate of expansion and contraction of the Sahara Desert. This analysis could have major policy implications toward combating desertification. From the satellite data, NASA calculated a normalized difference vegetation index (NDVI) for an area of the central Sahara as well as along the desert's southern boundary and the Sahel. NASA plotted the vegetation variation by year to determine changes in vegetation productivity. For 1980–90 alone, it found great variation in biomass productivity over time and space, indicating that some fluctuation is normal. This variation suggests resilience on the part of the Saharan-Sahelian transition zone, but the data remain inadequate to answer some larger questions concerning desertification. Decades of study will be required to determine whether long-term expansion or contraction is occurring (Tucker, Dregne, and Newcomb 1991).

The USAID-funded Famine Early Warning System (FEWS) project is currently compiling NASA data toward a multidecade record of greenness in the Sahara. FEWS gathers primary data from other sources (such as AGRHYMET) to monitor the incidence of ecological stress and the

economic costs of land degradation (Olsson 1993). Though the main users of this information at the moment are donor groups, ways need to be explored in which FEWS's work could be applied toward better resources management at the local level.

### *Technical Assistance and Guidance at the Grassroots Level*

The promotion of sustainable and broad-based economic growth is often seen by donor agencies as one of their overall objectives. This kind of growth is essential in reversing the overall decline in the quality of life that has come as a result of economic, political, and social downturns. This deterioration has adversely affected many of the poorest of African countries, which are often those most affected by desertification.

In addition to sustainable growth, another common goal of donor agencies is the support of natural resources management strategies that design, support, and implement programs that will lead to sustainable increases in agricultural productivity and hence personal incomes, especially at the local level.

This approach is not at odds with the view that capital development, tree plantations, the set-aside of range areas, etc., are solutions. In essence, proper land management is the key. But, unless the technical assistance to avoid and, where feasible, to reverse the effects of desertification are carried down to the grassroots level—and unless all concerned are willing to take an honest approach to what is needed, what is possible, and what resources are at hand—no approach will succeed.

Education is the key to success. This includes education at all levels of government, as well as of the users and donors. There is an evolutionary process to changing traditional uses. Thus, early introduction to the vision is extremely important.

Often, large and expensive technical “fixes” do not work. Small pilot efforts that show short-term accomplishments have a better chance of gaining local support and therefore improve chances of succeeding in the long-term. Additionally, they

provide less costly opportunities to learn from mistakes and to refocus the direction of the effort. Remedial measures must be designed so that they are supportable by local expertise and technology unless outside funds are available in quantity and over a long term.

## Summary Guidelines

From the themes that recur across the initiatives discussed above, the following strategy guidelines can be drawn:

- Provide clear, consistent policy signals on resource tenure, local management rights, national political support and mobilization, prices, and access to credit.
- Focus on incentives for local participation. Offer a range of technical and socioeconomic options and allow for flexibility and adaptation.
- Use local trainers and intermediaries, who are more efficient and cheaper than outside agents.
- Use “model farmers” and resource managers to provide strong and positive demonstration effects.
- Assure a stable, long-term commitment to the natural resources sector. The rural economy is changing rapidly, and short-cycle projects fail to capitalize on those changes. Abandoned projects have a negative demonstration effect.
- Constantly validate assumptions about the development process. Consider how rural producers make management decisions, and take this into account with any prescriptive technical plans.
- Set realistic benchmarks and indicators of progress. Unless the national governments and donors involved can critically demonstrate progress in this direction, and can clearly show that particular levels of participation have been achieved, there will be little interest in the future in plans to combat desertification.

## 4. Monitoring, Evaluation, and Mitigation

### *Planning Based on Indicators*

It is no secret that many bilateral and multilateral aid agencies were reluctant to fund the earlier desertification movement, because it seemed at the time like an unending, unrewarding task. However, there are many instances where people living and farming in arid and semiarid regions have succeeded even during the severe periods of drought in the 1980s. These are well documented (Shaikh et al. 1988). No matter what strategy is decided on to ensure the flow of donor funds in this sector, those people presently involved in antidesertification measures must receive credit for progress to date, in order to maintain any sort of credibility.

It is also important to note that much of the early information data base in this sector is unreliable or too generalized to be of use. It is gratifying to see that the information used in the recent UNEP report on the PACD (UNEP 1992b) was taken from the GEM/GRID 1991 data base. This data base may prove to be much more useful in carrying out regular reviews and updates than the earlier, more general data system. In addition, this approach will go a long way toward informing the general public of progress in the area of desertification. Clear, timely, and relevant information is necessary in securing "broad-based public participation ... essential to implementing the PACD." (UNEP 1992b). Involvement of local people in data collection gives them a sense of ownership and adds local credibility to any assessment results.

A holistic approach to monitoring and management is also necessary. One species surviving within a dryland ecosystem should not be relied on as an indicator of health. On the other hand, if several key species are used at low levels of monitoring, caution must be expressed about the reliability of the results. It should be borne in mind that

benchmark soils and sites often reveal trends before they occur on other sites. Therefore, monitoring and management for all actions must consider *the entire ecosystem* that may be affected. It should be reiterated that the value of natural resources lost as a result of an action should not be greater than the value received as a basis for that action. Thus, a threshold should be established that determines when the action should take place and when it should not.

There should be improved international collaboration in interdisciplinary monitoring. Countries located in deserts and in arid and semiarid lands vulnerable to desertification should better coordinate their analyses of cultural behavior and environmental conditions with other nations on desert margins. Here, the international agencies could play an increased role. Developing countries should continue to exert pressure on international organizations or nations that have complementary resources in statistical analysis and satellite-based data analysis. In addition, measurements through a network design can be most beneficial, cost effective, and the least controversial in an international resource management program. Local, ground-based, low-cost monitoring of resource trends and conditions can often make remote sensing data more interpretable.

UNEP has set for the next 28 years in the area of desertification. These will be accompanied by targets for support measures along with practical measures at the field level to achieve these targets (UNEP 1992b, pp.48–61). It must be remembered, however, that the problem of desertification is "a problem that cannot be solved once and for all ... we are dealing with a process that will generate new problems to be tackled once the more urgent ones have been dealt with" (UNEP 1992b).

In this regard, two more steps are needed in the desertification sector that were not discussed in any detail in Agenda 21. Specifically:

1. Realistic benchmarks should be assigned to the above targets at country level, along with indicators of progress that are achievable.
2. Provision of a “feedback loop” must be made to ensure that country governments and donors react to the benchmarks and indicators. Thus, if particular project activities are not achieving the targets set, or if the indicators show there is some impact, the project activities should be modified or a course correction in a given program carried out.

Because desertification is a process, it is all the more important that the above targets be accompa-

nied by *realistic benchmarks and indicators of progress*. Otherwise, there will always be calls for an “increased international effort” to resolve the problem.

Setting realistic benchmarks and designing effective indicators is a difficult task in any field but is especially difficult in the natural resource management sector. For example, Target “e” under the support measures states, “Making land users the main actors in designing and implementing the Plan and ensuring full public participation in antidesertification campaigns” (UNEP 1992b). This is an intriguing and exciting target. *But, unless the national governments and donors involved can demonstrate progress in this direction, and can clearly show that particular levels of participation have been achieved, there will be little momentum to maintain support.*

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